

# NATURAL HISTORY SURVEY

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## THE HIGHER FUNGI OF THE CHICAGO REGION

BY

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## PART II THE GASTROMYCETES



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## LETTER OF TRANSMITTAL

CHICAGO, May 1, 1923.

MY DEAR SIR: By the recommendation of the Board of Scientific Governors, approved by the Board of Trustees of The Chicago Academy of Sciences, I herewith submit to you for publication a report on the Gastromycetes to be issued under the rules of the Academy governing such matters, as Part II of Bulletin No. VII, on the Higher Fungi of the Chicago Area, prepared by Dr. Will Sayer Moffatt.

Respectfully,

CHARLES F. HILLS,

*Secretary.*

To DR. HENRY C. COWLES,

*President of The Chicago Academy of Sciences.*

## GASTROMYCETES.

Under this head botanists have grouped several forms of saprophytic fungi, quite diverse in appearance and manner of development, but agreeing in having their spores matured within a closed receptacle.

The principal forms in our region are:

A. THE PHALLOIDS OR STINKHORNS. In these the receptacle known as a volva, is gelatinous, and grows underground. The stem, bearing the carpophore is erected as the spores ripen. These plants usually are carrion-scented and attract large numbers of houseflies. These flies feed upon the moist gleba and devour numerous spores. Experiments have shown that these spores pass through the digestive tract of the flies without losing their viability, and thus are disseminated by them. The mycelium often grows from buried roots, and in some species at least, appears to be perennial. Specimens of *Ithyphallus impudicus* and *Dictyophora duplicata* have been observed on lawns in the exact spots occupied by the sporophores in preceding years.

B. THE LYCOPERDACEAE OR PUFFBALLS. Under this heading may be considered the *Calvatias*, *Lycoperdons*, *Bovistas*, *Bovistella*, *Geasters* and *Tylostomas*. In all of these the outer coating of the carpophore called the peridium, is developed above the ground. The peridium is double, the exterior called the exoperidium may be warty, spinulose or powdery; the inner called the endoperidium is of a thin, papery texture. In *Calvatias* and *Lycoperdons* most of the species are sessile or nearly so; the exoperidium disappears with age, and an opening appears at the apex of the endoperidium through which the spores escape. In *Calvatia* the opening is indefinite, the whole top of the carpophore finally disappearing. In *Lycoperdon* it is at first a small more or less circular opening. In *Bovista* and *Bovistella*, the carpophore breaks away from its attachment to the mycelium, and is blown about by the winds, the whole structure gradually disintegrating. In *Geaster*, the exoperidium is thick and breaks into stellate lobes. In *Tylostoma* the carpophore is elevated on a stem which remains in the ground. In this and in *Geaster* the spores escape from an opening at the summit of the endoperidium.

The interior of a puffball is filled with long, slender, often colored threads called hyphae. These arise from the lower or central portion of the peridium. In mass they are called the capillitium. On these hyphae the spores are borne. The origin and arrangement of these hyphal threads and the size and appearance of the spores are made use of in determining species.

C. THE NIDULARIACEAE OR "NEST FUNGI." In these the carpophores resemble little inverted bells, at first covered across the mouth with a thin white membrane called the operculum.



Within the bell or "nest" are a number of lentil-shaped structures called peridioles. Inside of these the spores are borne. The carpophores may be erumpent on decaying wood, manure, old boards, old paper, or any place where there is a supply of cellulose.

D. THE SCLERODERMAS. In these the peridium is a firm single layer, the cortex persistent in the form of warts, scales or granules, indehiscent or breaking up in an irregular or more or less stellate manner; convex internally at the base. Capillitium absent.

A few of our species of Gastromycetes are lignicolous. The greater number however grow upon the ground, and appear to derive their nourishment from the dead roots of grasses and other vegetation, or from indistinguishable fragments of vegetable tissues that are present in the soil, disintegrating it and thus preparing the earth for a new series of the higher plants.

The most recent and comprehensive study of this group is that made by Mr. C. G. Lloyd, of Cincinnati, whose work has been published in various issues of "Mycological Notes." In addition to adopting his classification, I am indebted to him for the identification of several species of Lycoperdon, Geaster and Tylostoma. I am indebted also to my wife, Elizabeth M. Moffatt, for valuable assistance in preparing the illustrations of many of the species.

## GASTROMYCETES.

Terrestrial fungi, growing usually on the ground, rarely on wood; membranaceous, coriaceous or fleshy. Hymenium usually concealed within a continuous peridium until the spores are mature. Spores borne on basidia, continuous, sphaeroidal or ellipsoidal, hyaline or colored.

## DESCRIPTION OF GENERA AND SPECIES.

### ORDERS OF GASTROMYCETES.

1. Fleshy-gelatinous, erumpent from a volva; gleba or hymenium mucilaginous-deliquescent..  
.....*Phallales*.
2. Coriaceous; peridium simple or double, cyathiform, opening at the top, bearing lenticular sporangioles within.....*Nidulariales*.
3. Membranaceous-coriaceous; peridium usually double; gleba at first fleshy-cellulose, at length a powdery mass of capillitium and spores.....*Lycoperdales*.
4. Coriaceous; peridium simple; gleba sub-persistent; capillitium none.....*Sclerodermatales*.

### PHALLALES.

Mycelium funicular; fructification consisting of a volva, receptacle and gleba, at first spherical or ovoid, the volva including the receptacle and gleba. Volva composed of gelatinous layers, firmer exteriorly. Receptacle of various shapes, at length exserted from the volva, covered with a shining pulp, which as the fungus matures deliquesces and fills the cup-shaped volva. Spores minute, ellipsoidal.

### KEY TO GENERA OF PHALLALES.

1. Pileus none; gleba borne along the upper portion of the receptacle.....*Mutinus*.
2. Pileus present; gleba borne on its upper surface; veil present.....*Dictyophora*
3. Pileus present; gleba borne on its upper surface, veil none.....*Ithyphallus*.

### MUTINUS.

Receptacle consisting of a hollow stipe, without pileus or veil. Gleba borne on the outer surface of the upper portion of the pileus.

**Mutinus caninus** (Huds.) Fr. Plate I.

Stipe hollow, cylindric-fusiform, 6 to 15 cm. tall, 1 cm. thick, flesh-colored, perforate or imperforate at the apex.

Found occasionally in woods and thickets throughout our district. Plants usually 10 to 13 cm. high, the pileus occupying the upper third. Odor fetid, volva pinkish-gray, spores 4 by 5.2 u.

## DICTYOPHORA.

Receptacle consisting of a hollow stipe, a pileus and veil, the latter hanging from the upper part of the stipe as a cylindrical net or membrane.

**Dictyophora duplicata** (Bosc.) Ed. Fischer. Plate II.

Pileus campanulate, the surface sculptured with strong reticulating ridges and crests, which pass into the recurved border or collar formed by the union of the apex of the stipe with the pileus.

Stem cylindrical, tapering at each end, hollow. Veil reticulate, variable in length, but covering usually about one-half of the stipe. Gleba dark green; odor extremely fetid.

Plant 15 to 20 cm. high; stem 2.5 to 3 cm. in diameter; pileus about 5 cm. high.

On the ground in a water-meter box, Wheaton, 1899. When first noticed, August 20th, there were three plants, each about an inch in diameter, growing on the ground like Lycoperdons, which I mistook them to be. Visiting the spot after two weeks' absence, I found that one of the plants had died, while another had thrown up its stipe and fallen into decay. The cover was removed from the box so that the remaining plant could receive light. It matured September 25th, thirty-five days after it was discovered. The veil in this specimen, extended to the base of the exposed portion of the stipe. The species has also been collected at Winfield, growing in rotten wood at the base of a stump. The delicate, lace-like veil is very beautiful.

## ITHYPHALLUS.

Receptacle consisting of a hollow stipe and of a pileus bearing the gleba on its outer surface. Veil none.

**Ithyphallus impudicus** (L.) Fr. Plate III and IV.

Pileus conic-campanulate, showing the outer surface sculptured with reticulated ridges and crests after the deliquescence of the gleba. Veil wanting; volva whitish or pinkish.

Stem hollow, tapering at each end, joined at its upper end with the pileus by a recurved border.

Plant 15 to 25 cm. high; stipe 3 cm. in diameter; pileus about 5 cm. high.

In lawns, neglected places in gardens, under shrubbery, etc. September. In autumn, 1899, over thirty young plants appeared under a clump of trees bordering a lawn in Wheaton, after a few days of warm rain. Dry weather followed lasting several weeks, during which all of the plants withered without coming to maturity.

The rapidity of growth of this species is remarkable. A plant still in its globose form, just beginning to rupture at the apex, was placed in a fruit jar. In three hours it had put up a stem to the height of 12 cm. surmounted by the usual pileus. A mass of slimy fluid surrounded the volva at the bottom of the jar.

## NIDULARIALES.

Spores developed in distinct globose or usually compressed sporangia formed within a cylindrical or cup-shaped peridium, which opens usually by the dehiscence of an operculum or epiphragm.

### KEY TO THE GENERA.

1. Peridium tubular-trumpet-shaped, of three layers.....  
.....*Cyathus*.
2. Peridium globose, then short-cylindric, of one layer.....  
.....*Crucibulum*.

### CYATHUS.

Peridium tubular trumpet-shaped, composed of three adnate layers; at first closed by a white membrane or epiphragm, then widely open at the top; sporangioles flattened disk-shaped, umbilicate beneath and attached to the wall of the peridium by a compound funiculus.

### KEY TO THE SPECIES OF CYATHUS.

1. Peridium campanulate, ashy-gray or brownish; sporangioles cinereous..... *vernicosus*.
2. Peridium narrowly obconic, brownish fawn-color; sporangioles blackish..... *stercoreus*.
3. Peridium obconic, dark brown; sporangioles cinereous then whitish..... *striatus*.

**Cyathus vernicosus** (Bull.) DC. Plate V. Fig. 1.

Peridium campanulate with wide-expanded or recurved mouth, substipitate; outer surface sparingly silky-hairy, then almost smooth, ashy-gray or brownish; inner surface smooth, shining, dark-gray to lead-color; sporangioles circular, flattened beneath, cinereous; spores ellipsoid, hyaline,  $13 \times 7$  u.

Plants 8 to 12 mm. high, 5 to 15 mm. broad at the mouth; sporangioles  $2\frac{1}{2}$  mm. broad.

On partially buried sticks, chips, etc., about dwellings and barnyards. Spores in our plants about  $10 \times 7$  u., often with one end rounded, the other slightly pointed. Readily distinguished from our other species by the wide bell-shaped mouth of mature plants.

**Cyathus stercoreus** (Schw.) DeToni. Plate V. Fig. 2.

Peridium thin, narrowly obconical, tapering to a slender base; outer surface brownish fawn-color, at first strigose-hirsute, then becoming canescent, finally bare; inner surface glabrous, shining, lead-color; sporangioles blackish, smooth, discoid, depressed beneath.

Spores hyaline,  $28$  to  $32 \times 22$  to  $24$  u. (V. S. White).

Plants .5 to 1.5 cm. high, 4 to 8 mm. wide at the top, 1 to 3 mm. at the base.

On dung in a woodland pasture. Winfield. Our specimens are 5 to 7 mm. high, 3 to 4 mm. wide at the mouth which is usually compound and irregular (not terete). The spores are nearly globose, somewhat larger than the dimensions given above, being from 22 to 35 mm. broad.

Readily distinguished from *C. vernicosus* by the size and shape of the spores, as well as by the form of the peridium.

**Cyathus striatus** (Huds.) Hoffm. Plate VI. Fig. 1.

Peridium obconical or straight-trumpet-shaped; outer surface dark-brown, persistently rough-hairy; inner surface lead-colored or brownish, glabrous, longitudinally plicate; at length opening at the top by the detachment of the epiphragm; sporangioles cinereous becoming whitish, at first circular, then angular from mutual pressure; spores hyaline, broadly cylindrical with obtuse ends, 12 to 15 x 6 to 8 u.

On sticks, nut-shells, bark of old trunks, etc. Plant 10 to 20 mm. high, 8 to 10 mm. broad. Solitary or in clusters.

## CRUCIBULUM.

Peridium at first globose, then short-cylindrical, simple, of one layer which is continuous over the mouth, forming a lid-like structure, the lid at length disappearing and the peridium becoming crucible-shaped; sporangioles numerous, disk-shaped, smooth, whitish, each with a globular process beneath, the lower part of which is attached to the inner wall of the peridium.

**Crucibulum vulgare** Tul. Plate VI. Fig. 2.

Peridium globose, at first closed, sessile by a truncate base, at length cylindric-crucibuliform; outer surface fawn-colored and velvety when young, becoming furfuraceous and grayish with age; inner surface whitish, satiny-shining; sporangioles crowded, circular, flattened, 1½ to 2 mm. broad; spores smooth, ellipsoid, 9 x 5 u.

On dead sticks in woods. Millers, Indiana. In the crevices of plank sidewalks, Wheaton.

Plants 5 to 7 mm. high and broad, the walls often flattened from mutual pressure. The furfuraceous coating disappears with age, leaving the outer surface rugose. Young plants are creamy-ochre or pale fawn-color, the lid-like covering usually darker.

## LYCOPERDALES.

Terrestrial, rarely hypogaeal fungi, often globose or pyriform, sessile or stipitate; peridium membranaceous-coriaceous, usually double, dehiscent by the breaking down of its walls or by an apical mouth; gleba fleshy-cellulose, at maturity commonly pulverulent; spores subsphaeroid, smooth or warted, hyaline or variously colored.

## KEY TO THE GENERA.

1. Outer peridium thick, splitting into star-like segments which become reflexed.....*Geaster*.  
Outer peridium fragile, more or less deciduous, often clothed with warts, spines or scales..... 2
2. Peridium stipitate..... 3  
Peridium sessile..... 4
3. Columella, if present, not extending to the apex . *Tylostoma*.  
Columella extending to the apex. capillitium. wanting.....*Secotium*.
4. With a more or less thickened base (subgleba)..... 5  
Without a thickened base..... 8
5. Peridium gradually breaking up into fragments from above downward.....*Calvatia*.
6. Peridium opening by a simple apical mouth..... 7
7. Spores sessile.....*Lycoperdon*.  
Spores pedicellate.....*Bovistella*.
8. Peridium membranaceous, opening irregularly or by an apical mouth; threads of the capillitium short, several times dichotomously branched . *Bovista*.
9. Peridium very thick, the upper portion breaking up irregularly; threads of the capillitium short, with a few branches and scattered prickles.. *Mycenastrum*.

## GEASTER.

Peridium subglobose, of three layers, the two outermost usually continuous and splitting from the apex in a stellate manner; inner layer sessile or pedicellate, opening by a single apical aperture; subgleba prominent or rudimentary; spores colored, rough, globose.

## KEY TO THE SPECIES OF GEASTER.

1. Exoperidium hygrometric, strongly incurved when dry.... 2
2. Exoperidium thick, expanded plant 3-5 cm. broad.....  
.....*hygrometricus*.  
Exoperidium thin, expanded plant 2-2.5 cm. broad.....  
.....*delicatus*.  
Exoperidium not incurved when dry..... 3
3. Mouth of endoperidium sulcate.....*schmidelii*.  
Mouth of endoperidium even..... 4
4. Unexpanded plant acute..... 5  
Unexpanded plant globose..... 6
5. Exoperidium saccate.....*saccatus*.  
Exoperidium not saccate.....*triplex*.
6. Plant reddish-brown.....*rufescens*.  
Plant blackish.....*limbatus*.

**Geaster hygrometricus Pers.** Plate VII. Fig. 1, 2.

Outer peridium deeply parted into 7 to 20 acute, hygrometric segments, these reflexed when moist, strongly incurved when dry; inner peridium depressed-globose, sessile, whitish, becoming gray or brownish; mouth an irregularly torn aperture, stellate, scarcely protruding; threads of the capillitium thinner than the spores; spores globose, rough, pale-brown, 8 to 11 u.

Frequent in sandy pine woods at the head of Lake Michigan. Not reported from any other localities in our district. Specimens that have been kept in the herbarium several years still retain their hygroscopic property, and when placed in water will open as readily as those found in the field. Inner peridium 10 to 20 mm. in diameter, segments of the outer peridium expanding to a width of 5 to 8 cm.

**Geaster delicatus Morgan.** Plate VIII. Fig. 1.

Outer peridium thin, cut into 6 to 10 unequal segments. Inner peridium sessile, subglobose, pallid to pale brown, the mouth plane, lacerate; spores pale brown, minutely warted, 5 to 6 u.

In sandy woods at the head of Lake Michigan. The outer peridium is hygrometric. During wet weather the segments lie flat on the ground.

**Geaster schmidelii Vitt.** Plate VIII. Fig. 2.

Outer peridium brown, pedicellate, multifid, the segments 6 to 8, strongly reflexed; mouth conical, sulcate; spores brown, globose, minutely warted, 3.5 to 5 u.

In a grassy pasture, Glen Ellyn. May. Our specimens were of the preceding year's growth, badly weathered and not attached to the soil. Probably gregarious, as a dozen or more plants were found in a small area apparently near the place where they had grown. Inner peridium 8 to 10 mm. in diameter; segments of the outer peridium expanding to 3 or 4 cm. Also found at Bartlett, in an open woodland pasture, September, 1904.

**Geaster saccatus Fr.** Plate IX., X.

Outer peridium multifid, the segments 6 to 9, recurved; inner peridium globose, sessile, mouth determinate, conic, seated in a definite circular area; threads of the capillitium much thicker than the spores; spores minutely rough, 3.5 to 5 u. Inner peridium 2 to 3 cm. in diameter; outer peridium expanding to 4 or 5 cm.

Under trees in moist woods. Glen Ellyn. One autumn more than five hundred specimens were found under an oak tree.

**Geaster triplex Jungh.** Plate XI. Fig. 1.

Outer peridium 5 to 8-parted, the thick fleshy layer breaking away about the middle and forming a cup; inner peridium subglobose, sessile, pallid, or brownish, the mouth broadly conic,

ciliate-fimbriate, seated in a definite circular area; threads of the capillitium thicker than the spores; spores globose, minutely warted, pale-brown, 3 to 6 u.

Gregarious under trees in woods, Bowmanville, Bartlett, Glen Ellyn. Our largest Geaster. The segments expand to 8 or 10 cm. Unexpanded specimens were found at Glen Ellyn in August, 1904. These are subglobose, mycelio-attached, 2.5 to 4 cm. broad, with a prominent mammaeform apex 3 to 5 mm. high; outer coating very thin, rusty-brown, areolately cracking, disclosing the cervine surface of the peridium.

**Geaster rufescens** Pers. Plate XI. Fig. 2.

Outer peridium multifid, the segments, 6 to 8, recurved; inner peridium globose or broadly ovoid, subsessile, reddish-brown; mouth indefinite, fibrillose; threads of the capillitium thicker than the spores; spores globose, minutely warted, 3 to 6 u.

Under oak trees. Glen Ellyn. Inner peridium about 2.5 cm. in diameter, the segments of the outer peridium expanding to 6 or 8 cm.

On a rotten stump, Bartlett. Inner peridium distinctly pedicellate.

**Geaster limbatus** Fr. Plate XII. Fig. 1.

Outer peridium multifid, the segments 8 to 10, recurved; inner peridium globose or broadly obovoid, somewhat depressed above, dark brown, pedicellate; mouth a little elevated, somewhat lacerate, ciliate-fimbriate; threads of the capillitium thicker than the spores; spores globose, brown, minutely warted, 4 to 5 u.

About trees and stumps. Glen Ellyn. Near *G. rufescens*, but that species has a reddish-brown inner peridium.

## TYLOSTOMA.

Peridium subglobose, dehiscing by an apical aperture, cortex deciduous; stem lacerate-scaly, elongated, distinct from the peridium; capillitial threads long, hyaline, nodulose at the prominent septa; mycelium fibrous, much branched, often forming with the inclosed soil a bulb-like mass at the base of the stem.

### KEY TO SPECIES OF TYLOSTOMA.

1. Plant 2.5 to 7 cm. high..... 2
2. Mouth irregular, lacerate.....*campestre*.
3. Mouth shield-shaped, fimbriate.....*poculatum*.
4. Mouth entire..... 5
5. Plant 5 to 10 cm. high.....*verrucosum*.
6. Plant 2 to 3 cm. high.....*mammosum*, var.

**Tylostoma campestre** Morg. Plate XII. Fig. 2.

Peridium depressed-globose, the brown scaly cortex gradually falling away; inner peridium thickish, submembranaceous, becoming smooth and whitish; mouth plane, irregular, lacerate, not fimbriate.



Stem nearly equal, with broad brown scales, white within and fibrillose-stuffed, with a small mycelial bulb at the base. Threads of the capillitium long, slender, about as thick as the spores, hyaline, branched; spores subglobose, pale brown, minutely warted, 4.5 to 5.5 u.

Plant 2.5 to 7 cm. high; peridium 1 to 2 cm. broad; stem 6 mm. thick.

Gregarious in sand, Millers, Indiana. In colonies of a hundred or more individuals.

**Tylostoma poculatum** White. Plate XIII. Fig. 1.

Peridium depressed-globose, smooth, reddish-brown; mouth strongly raised, shield-shaped, fimbriate. Cortex thick, persisting at the base of the peridium in the form of a cup. Stem smooth, inconspicuously striate, whitish, thickened below.

In sand, Millers, Ind., October. Peridium 1 to 1.5 cm. in diameter; stem 2 to 3 cm. long, 3 to 4 mm. thick. In our specimens the cortex adheres like a sheath to the stem, often covering it nearly to the apex.

**Tylostoma verrucosum** Morg. Plate XIII. Fig. 2.

Peridium depressed-globose, thickish, becoming firm and rigid, with a dense brown cortex of minute persistent warts and scales; mouth small, circular, prominent, entire.

Stem long, slender, lacerate-scaly, internally white, with a central pith of long, loose fibres; mycelial bulb large, irregularly depressed-globose. Threads of the capillitium long, about as thick as the spores, hyaline, branched; spores irregularly globose, minutely warted, pale brown, 5 to 6 u.

Plant 5 to 10 cm. high, peridium about 12 mm. in diameter.

In sandy woods. Edgewater. Nov. 1905. Mrs. G. W. Gray. The mouth of the peridium in our plants is often narrowly elliptical. The scales fall away from the upper portion of the peridium but are persistent below. Mingled with them are numerous particles of sand, suggesting that the cortex may have been viscid at the time the peridium emerged from the ground.

**Tylostoma mammosum** Fr. var? Plate XIV.

Peridium subglobose, the brown scaly cortex retreating leaving the greater part of the inner peridium exposed; inner peridium smooth, membranaceous, at first pale ocraceous, becoming chalky-white with age; mouth short-tubular with a circular opening, at first slightly darker than the peridium, becoming chalky-white.

Stem slender, irregularly striate, sparsely scaly, cream-color, white within, stuffed; mycelial bulb small.

In sand, Winthrop Harbor and Beach, Ill., and Millers, Ind., October; Clarke, Ind., August.

Specimens were submitted to Mr. C. G. Lloyd, who wrote me that this plant "apparently does not have a name at present; that

it is commonly referred to *T. mammosum*, but differs materially from that species; that the European *T. mammosum* does not occur in this country."

## SECOTIUM.

Peridium subglobose to conical-ovoid, usually stipitate, dehiscing irregularly at the base; stem extending as a columella to the apex; gleba cellulose; capillitium wanting; spores colored, usually ellipsoidal.

***Secotium acuminatum*** Mont. Plate XV.

Peridium subglobose to conical-ovoid, whitish becoming brownish at maturity, smooth or somewhat squamose, sessile or short stipitate, rupturing about the base by several longitudinal fissures.

Stem extending upward as a columella to the apex of the peridium. Spore-mass snuff-brown. Spores smooth, yellowish-brown, spherical to ellipsoidal, often apiculate, about 8 x 6 u.

Fields and pastures. Bertolet, Moffatt.

Collected in Chicago in 1876 by Mr. H. L. Warne, and described by Prof. Peck in Bull. Torr. Cl. 6: 77, as *Lycoperdon Warnei*. It appears as *Podaxon Warnei* in U. S. Sp. Lycoperdon p. 34; as *Secotium Warnei* in Bull. Torr. Cl. 9: 2, and in Bull. N. Y. Mus. 67: 28. The studies of Prof. Trelease and Mr. Lloyd indicate that our plant is not specifically distinct from the European *S. acuminatum*.

## CALVATIA.

Peridium large, globose or turbinate with a stem-like base; cortex thin, smooth or granular, soon deciduous; endoperidium thick but fragile, at maturity breaking up into fragments from above downward; subgleba prominent, definitely limited above; capillitium dense, the threads long, slender, branched; spores small, colored, globose.

### KEY TO THE SPECIES OF CALVATIA.

1. Globose or depressed, white, becoming pale brownish.  
.....*Bovista*.
2. Turbinate, contracted below into a short, thick, stem-like base..... 3
3. Endoperidium pale to dark purple.....*cyathiforme*.  
Endoperidium ochraceous to bright brown.....  
.....*craniiformis*.  
Endoperidium orange-red to orange-brown.....  
.....*rubro-flava*.
4. Depressed-globose, abruptly contracted into a long, stem-like base; endoperidium white or gray.....*saccata*.

**Calvatia Bovista** (L.) McBride. Plate XVI.

Globose or depressed; outer peridium a delicate, closely adherent layer; inner peridium thin, tough then fragile, breaking away irregularly from above downward, white then brownish; threads of the capillitium much branched, thicker than the spores, olivaceous-brown, long persistent; spores subglobose, even, 3.5 to 4.5 u.

Plant usually from 15 to 30 cm. in diameter.

Rich bottom of the Dupage river, near Glen Ellyn, Moffatt, B. F. Gault; North of Chicago, Dr. Watson. This species, commonly known as the "giant puff-ball" is quite rare in our district. I have seen but one growing specimen but have several times collected the persistent bases of plants that still contained portions of the characteristic spore-mass.

In the American Naturalist, 18: 570, is an account of a specimen collected in Herkimer county, New York that was "irregularly oval, five feet four inches by four feet six inches in diameter, and nine and a half inches high." Other collectors have reported specimens measuring from 50 to 80 cm. Plants of such immense size are extremely rare and attract attention whenever found. No specimens of unusual size have been reported from the vicinity of Chicago.

**Calvatia cyathiforme** (Bosc.) Morgan. Plate XVII. Fig. 1.

Broadly obovoid or turbinate, depressed or flattened above, with a short, thick base and cord-like root; outer peridium smooth, thin, fragile, whitish-brown to brownish-purple, the upper part often areolately cracked, soon flaking off; inner peridium thin, pale to dark purple, velvety, fragile, at maturity breaking up into fragments and falling away. Subgleba occupying from one-third to one-half of the peridium, cup-shaped above, a long time persistent; capillitium and spores brownish-purple; threads very long, scarcely branched, thinner than the spores. Spores globose, echinate, sessile, 4.5 to 6 u.

Plant 7 to 15 cm. in diameter.

On the ground in pastures and meadows. Frequent after rains in summer and autumn. Edible and of excellent flavor.

**Calvatia craniiformis** (Schw.) Morg. Plate XVII. Fig. 2.

Obovoid or turbinate, depressed above, the base thick and stout with a cord-like root; outer peridium thin, furfuraceous, pallid or grayish, breaking up into small areolae; inner peridium thin, fragile, ochraceous to bright brown, the upper part breaking up into fragments at maturity and falling away; subgleba occupying about one-half of the peridium. Capillitium and spores greenish-yellow, becoming dirty-ochraceous; threads very long, about as thick as the spores, branched; spores globose, even, 3 to 3.5 u., with a short pedicel.

Plant 7 to 18 cm. in diameter.

On the ground in woods near Wheaton. September.

**Calvatia rubro-flava** Cragin. Plate XVIII.

Obconic, tapering gradually to the rooting mycelium, cortex thin, furfuraceous or granulose, with a few short, scattered spinules above; inner peridium thin and fragile, at first whitish, soon becoming orange-red to orange-brown, after maturity the upper part breaking up into fragments and falling away. Subgleba occupying about one-third of the peridium; mass of spores and capillitium reddish-ochre then olivaceous-orange, the threads very long, rather thicker than the spores, branched; spores globose, even, 3 to 3.5 u.

In sand, on the bank of a drainage ditch, Millers, Ind., August, September. Bertolet, Moffatt.

**Calvatia saccata** (Vahl.) Morg. Plate XIX. Fig. 1.

Plant depressed-globose above, plicate below and abruptly contracted into a long stem-like base; base thick and stout, often lacunose, nearly equal; mycelium fibrous. Outer peridium very thin, composed of minute persistent spinules or granules; inner peridium white or gray becoming brownish, thin and fragile, after maturity soon breaking up into fragments and falling away. Subgleba occupying the stem-like base, persistent. Spores and capillitium brownish-olivaceous, the threads very long, branched, the main stem thinner than the spores. Spores globose, warted, 5 to 6 u.

Plant 2.5 to 5 cm. in diameter, 7.5 to 12.5 cm. high, the stem-like base 2.5 cm. or more thick.

Among moss in a tamarack swamp southeast of Millers, Ind. Moffatt and Bertolet.

## LYCOPERDON.

Peridium globose or pyriform, often with a stem-like base; cortex becoming broken up into subpersistent warts, spines or granules; endoperidium smooth, dehiscing by a small apical aperture; subgleba variable in size; capillitium dense, the threads usually branched; spores small, colored, globose or ellipsoidal.

### KEY TO THE SPECIES OF LYCOPERDON.

1. Cortex of long, whitish spines..... 2
2. Capillitium purple when mature.....*pulcherrimum*.  
Capillitium greenish-yellow.....*gemmatum*.
3. Cortex of reddish-brown granules, peridium buff  
or brownish.....*pyriforme*.
4. Cortex of pyramidal warts, peridium dark brown.....  
.....*cruciatum*.
5. Cortex of soft white spines; peridium pale buff.....  
.....*wrightii*.
6. Cortex a thin furfuraceous coat; peridium  
olivaceous or pale brown..... 7

7. Mycelium cord-like; scales of the outer peridium disappearing.....*cepaesforme*.

Scales persistent.....*pusillum*.

8. Mycelium fibrous.....*molle*.

**Lycoperdon pulcherrimum** B. and C. Plate XIX. Fig. 2.

Obovoid, with a short stout base and a thick, cord-like root; cortex of very long white spines convergent at the apex; these at length dehiscent, exposing the smooth purplish-brown shining surface of the inner peridium; subgleba occupying about one-third of the peridium; spore-mass and capillitium olivaceous then brownish-purple; spores globose, minutely warted, 4.5 to 5.5 u. Plant 2.5 to 6.5 cm. in diameter.

Low ground in woods. Winfield. Infrequent. Mr. Morgan states that the plants have a strong "and not unpleasant fragrance." *L. Frostii* Peck, is said to be a synonym. For an excellent figure, see Lloyd's photogravure, No. 19.

**Lycoperdon gemmatum** Batsch. Plate XX. Fig. 1, 2.

Turbinate, depressed above, base short and obconic or more elongated and tapering or subcylindric, arising from a fibrous mycelium; cortex of long, thick, erect, whitish or gray spines of irregular shape, with intervening smaller ones; the larger spines at length falling away leaving pale spots or reticulations on the surface of the inner peridium; subgleba occupying from one-third to one-half or more of the peridium; capillitium and spores greenish-yellow becoming pale-brown, the threads sparsely branched, about as thick as the spores; spores globose, finely granulated, 3.5 to 4.5 u. Plant 2.5 to 5 cm. in diameter, 2.5 to 7 cm. high.

On the ground in woods. Frequent, often gregarious, the color varying from whitish to pale-brown.

According to Mr. Lloyd (Myc. Notes, p. 167), this is the plant described by Persoon as *L. perlatum*, and should be known by that name. Mr. Massee, however (Journ. Roy. Mic. Soc. 1887, p. 710), separates them on account of "the umbonate mouth and distinct columella" of *L. perlatum*.

**Lycoperdon pyriforme** Schaeff. Plate XXI.

Obovoid or pyriform with an abundant mycelium of long, branching, white fibres; peridium buff or brownish, covered with persistent, coarse, reddish-brown granules, subgleba small, white; spore-mass and capillitium greenish-yellow then brownish-olivaceous, the threads branched, thicker than the spores; spores globose, even, 3.5 to 4.5 u., sessile.

On rotten logs and stumps and on the ground. Sometimes in dense clusters of several hundred individuals. Very variable in size and shape; 1.5 to 3 cm. in diameter, 2.5 to 5 cm. high. It is edible but lacks the appetizing flavor of the larger puff balls.

For figures, see Marshall, The Mushroom Book, pp. 124, 134; McIlvane, Am. Fungi, p. 602.

***Lycoperdon cruciatum* Rostk.** Plate XXII. Fig. 1.

Globose or depressed above, sessile; cortex of dense pyramidal substellate warts which peel off in patches; endoperidium dark brown, minutely furfuraceous; subgleba occupying from one-fourth to one-third of the peridium; capillitium and spores dingyolivaceous, the latter globose, smooth, 4 u.

Plant 2.5 cm. high, 2.5 to 5 cm. in diameter.

In pastures. Bertolet. Moffatt. Mr. Lloyd, who has studied this and allied species in European herbaria writes that "*L. marginatum* and *L. cruciatum* of Europe, as well as *L. separans* of the United States all have the same peculiar cortex and similar spores. If the species are in fact identical, our plant should bear the name *L. marginatum* Vitt."

For figures, see Morg. Myc. Fl. 14: 14, and Lloyd, Gen. *Lycoperdon* Eur. pl. 51, f. 1 to 11.

***Lycoperdon wrightii* B. and C.** Plate XXII. Fig. 2.

Globose, sessile, with a fibrous mycelium.; cortex of soft, fragile white spines which soon fall away, exposing the pale buff or straw-colored, smooth surface of the inner peridium; subgleba small, convex; spore-mass and capillitium greenish-yellow then pale-olive, the threads long, simple, hyaline, much thicker than the diameter of the spores; spores globose, finely granular, 3.5 to 4.5 u. Plant 8 to 18 mm. in diameter.

Short grass in pastures and in stubble fields. Autumn. Common, often abundant. Often several plants grow in a cluster. Their sides are then flattened by mutual pressure. Massee, in his monograph of the genus *Lycoperdon* states that the spores are "umber," which is a manifest error. According to Mr. Lloyd, "*L. Curtisii* Berk., is based upon immature specimens of *L. Wrightii*". In the description of both species Mr. Berkeley states that the spores are clay-color.

***Lycoperdon cepaesforme* Bull.**

Globose or depressed-globose, plicate underneath, with a cordlike root; cortex a thin, white, minutely furfuraceous coat, this soon rimulose, breaking up into small scales and patches which finally disappear from the pale or pale-brown surface of the inner peridium; subgleba nearly obsolete; spore-mass and capillitium greenish-yellow then pale-olivaceous, the threads much branched, the main stem thicker than the spores; spores globose, even, 3.5 to 4 u., often with a minute pedicel. Peridium 12 to 25 mm. in diameter.

Identified by Mr. Lloyd from specimens collected near Chicago by Dr. Watson. According to Mr. Lloyd (Myc. Notes, p. 167), this is the northern form of *L. polymorphum* Vitt.; *L. cepaesforme* is the usual American form with subglobose peridium and very little sterile base, while *L. coloratum* Pk. is the same species described just at the time the spores matured. Furthermore,

some of the plants referred by American authors to *L. pusillum* Batsch, are not the same as the European species but are probably only small globose forms of *L. polymorphum*.

***Lycoperdon pusillum*** (Batsch) Fr. Plate XXIII. Fig. 1.

Globose, sessile, with a slender cord-like root. Cortex thin, furfuraceous, drying up into minute squamules which are quite persistent on the pale brown surface of the inner peridium. Subgleba obsolete; capillitium and mass of spores greenish-yellow then brownish-olivaceous; spores globose, 4 u.

Sandy soil, Millers, Ind., October. Commonly caespitose or in scattered patches. I have not been able to distinguish this with certainty from small specimens of *L. cepaesforme*.

***Lycoperdon molle*** Pers.

Plant turbinate, depressed above, abruptly contracted into a short thick base, with a fibrous mycelium; cortex a thin, mealy, furfuraceous coat, whitish, yellowish or buff; this falling away and disclosing the smooth, shining, pale-olivaceous surface of the inner peridium; spore-mass and capillitium greenish-yellow then brownish-olivaceous, the threads about as thick as the spores, branched; spores subglobose, minutely echinulate, 3.5 to 5 u., with a minute pedicel.

In pastures and open woods, Glen Ellyn. Peridium is 12 to 25 mm. broad, globose or depressed; cortex occasionally persisting for a time after it has separated from the endoperidium. Capillitium and spores olivaceous, the latter globose, 3 u. The mature spores in our plants do not seem to be pedicellate.

The species is the one described by Morgan under the above name. Whether it is really the plant described by Persoon as *L. molle*, seems doubtful. See Lloyd, *Lycoperdons of the U. S.*, p. 237.

**BOVISTELLA.** Plate XXIII. Fig. 2.

Peridium globose or broadly obovoid, sometimes much depressed, plicate underneath with a thick, cord-like root. Spores sub-globose, with long, hyaline persistent pedicels.

*Bovistella ohiensis*, our only species is common in the sands of the dune region. Peridium 2.5 to 7.5 cm. in diameter, sometimes convex, but more often concave on the top.

**BOVISTA.**

Peridium in two layers, the outer fragile, deciduous, the inner thin, tough, smooth, long-persistent, finally dehiscent by a definite or irregularly torn apical orifice; capillitium dense, colored; subgleba absent; spores globose or oval.

## KEY TO THE SPECIES OF BOVISTA.

- Peridium 2.5 to 6 cm. in diameter; spores globose,  
sessile.....*pila*.  
Peridium 1 to 2.5 cm. in diameter; spores oval,  
pediceled.....*plumbea*.

**Bovista pila** B. and C. Plate XXIV. Fig. 1.

Plant irregularly globose with a stout, cord-like root; outer peridium very thin, soon disappearing; inner peridium thickish, smooth and shining, grayish-buff, dark-gray, or purplish-brown, often persisting through the winter and finally dehiscing by an irregular torn aperture near the apex; threads of the capillitium pale-brown or olivaceous, at length dark or purplish-brown, much branched; spores globose, even, sessile, brown, 4 to 5 u.

Common in woodland pastures. The plants vary greatly in size, from 2.5 to 6 cm., or in exceptional cases up to 10 cm. Berkeley, in the original description of the species (Grev. 2: 49), states that the spores are on pedicels about 5 mm. long, soon breaking off. In all the specimens I have examined the spores are sessile. Old, weathered specimens are often found in the woods in springtime, the peridium still unopened.

**Bovista plumbea** Pers. Plate XXIV. Fig. 2.

Plant irregularly globose, or depressed when old; outer peridium dull white, flaking away; inner peridium smooth, lead-colored, dehiscent at the apex by a round or oblong aperture; capillitium olivaceous, then purple-brown, the threads much branched; spores oval, even, brown, 6 to 7 x 5 to 6 u., on long hyaline pedicels.

Common in old pastures. Pileus commonly 12 to 25 mm. in diameter. Distinguished from *B. pila* by its darker color, smaller size and pedicellate spores. According to McIlvane, both of our species are edible.

## MYCENASTRUM.

Peridium subglobose, without a thickened base; cortex a thin, continuous layer, at length flaking away; endoperidium thick, tough, coriaceous, becoming hard, rigid and corky, the upper part finally breaking up into irregular lobes or fragments; capillitium originating within the tissues of the gleba, the threads short, sparingly branched, bearing scattered prickles. Spores large, globose, rough, brown.

**Mycenastrum Corium** Desv. Plate XXV. Fig. 1.

Globose, depressed-globose, sometimes elongated or often irregular, with a thick cord-like root. Cortex a thickish, white, soft, smooth, continuous layer, which after maturity cracks into large polygonal areas and at length falls away in large flakes or scales; inner peridium very thick, almost woody, finally breaking



up into irregular lobes or fragments; mass of spores and capillitium bright-olivaceous, then dark purple-brown, the threads flexuous, subhyaline, here and there spinulose, about as thick as the spores; spores globose, rough, 9 to 12 u., often with a minute pedicel.

In sandy soil, Bertolet, Moffatt, Watson. Usually 5 to 8 cm. in diameter. A specimen collected by Dr. Watson, measures 14 x 12 cm.

*M. spinulosum* Pk. is a synonym.

## SCLERODERMATALES.

Peridium thick, coriaceous, sessile or stipitate, opening irregularly at the apex; gleba containing numerous cells or cavities, the tramal plates disappearing, or persistent and inclosing peridiola; capillitium scanty or wanting.

Of the four genera reported from the United States, only one has been reported from our district.

## SCLERODERMA.

Peridium firm, cortex persistent in the form of warts or granules; endoperidium indehiscent or splitting in a stellate manner at the apex; gleba with the walls of the trama springing from every part of the peridium, subpersistent; spores large, globose, rough.

### KEY TO THE SPECIES OF SCLERODERMA.

1. Peridium irregular, sessile, rough-warty, 2.5 to 7 cm.....  
.....*vulgare*.
2. Peridium smoothish, tapering below, 2.5 to  
6 cm.....*flavidum*.
3. Peridium smoothish, sessile, less than 2.5 cm...*tenerum*.

***Scleroderma vulgare*** Fr. Plate XXV. Fig. 2.

Sessile, irregular; warted, peridium whitish to pale-brown, corky, hard, dehiscing indefinitely; capillitium and spore-mass bluish-black; spores globose, warted, 9 to 11 u.

Woodland paths and roads. Millers, Ind. Also collected near the lake shore north of Chicago, by Dr. Watson.

Less common than *S. flavidum* and *S. tenerum*; 2.5 to 6 cm. or more in diameter, often in colonies containing one large plant and several smaller ones. The entire peridium is clothed with coarse, elevated warts, giving it the appearance of some echinoderm rather than a plant. In large specimens the base is sub-plicate, and occasionally more or less concave below.

***Scleroderma flavidum*** E. and E. Plate XXVI. Fig. 1.

Depressed-globose, coriaceous, firm, light-yellow, roughened with innate, granular, minute warts above, smoother and sub-plicate below, with strongly developed yellowish roots forming

a mass in the sand as large as the peridium itself, and which remains fixed in the ground after the peridium has broken away; dehiscence stellate; capillitium and spores snuff-brown; spores globose, coarsely echinulate, 7 to 12 u. Plant at first entirely buried in the sand.

Sand of the lake shore. Near Chicago. Collected by Dr. Watson and identified by Mr. Lloyd. Also collected at Clarke and Millers, Indiana, where it is quite common.

Peridium 2.5 to 6 cm. in diameter. The irregularly stellate opening at the apex is smaller than the diameter of the plant, therefore the spore-mass is retained for a considerable time, and then gradually dissipated by the winds and rains.

**Scleroderma tenerum** B. and C. Plate XXVI. Fig. 2.

Globose, tender, pale-yellowish, clothed with pyramidal flat-topped scales; dehiscence stellate; stem short or wanting; mycelium membranaceous, pale-yellow; spores dark purple. Plant 12 mm. in diameter.

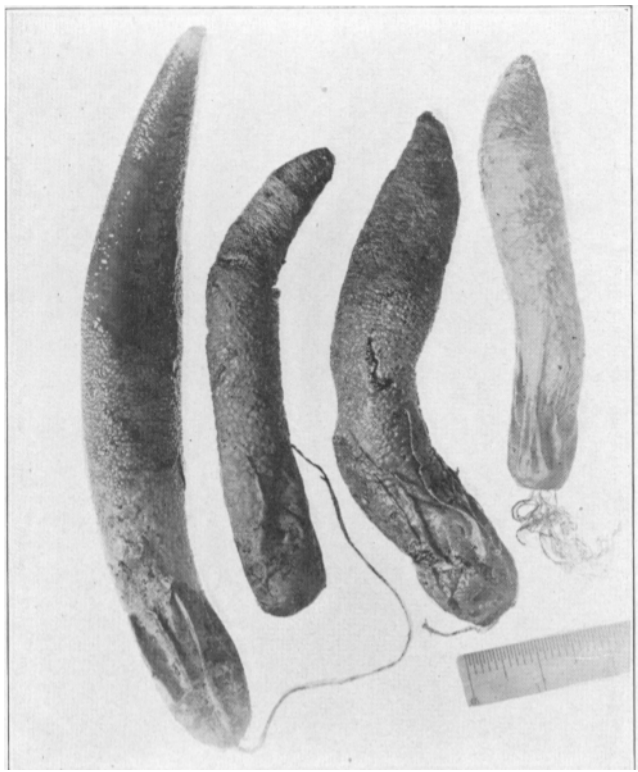
Frequent in short grass in pastures and open woods. Usually 12 to 18 mm. across, peridium thin, almost papery in texture and flexible when dry. The scales are irregular in size and shape, the mycelium is paler in color than the sessile peridium, the spores are globose, spinulose, 8 to 10 u. Mr. Lloyd, who kindly identified our specimens, states that the plant is commonly known as *S. verrucosum* in Europe, but is distinguished from that species by its small size, globose shape. According to Massee the spores of *S. verrucosum* are warted, 10 to 15 u.

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Species in lower case, Synonyms in *italics*.

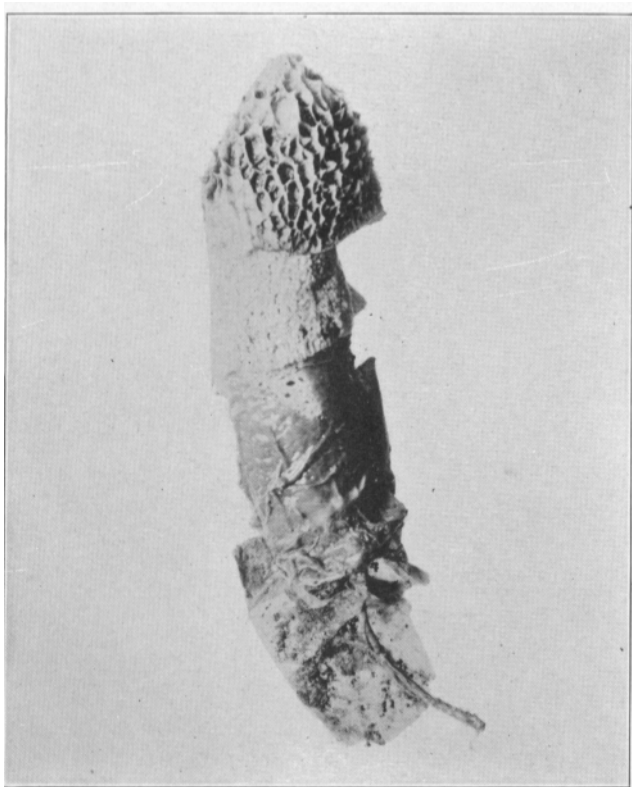
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PLATE I.



MUTINUS CANINUS.

PLATE II.



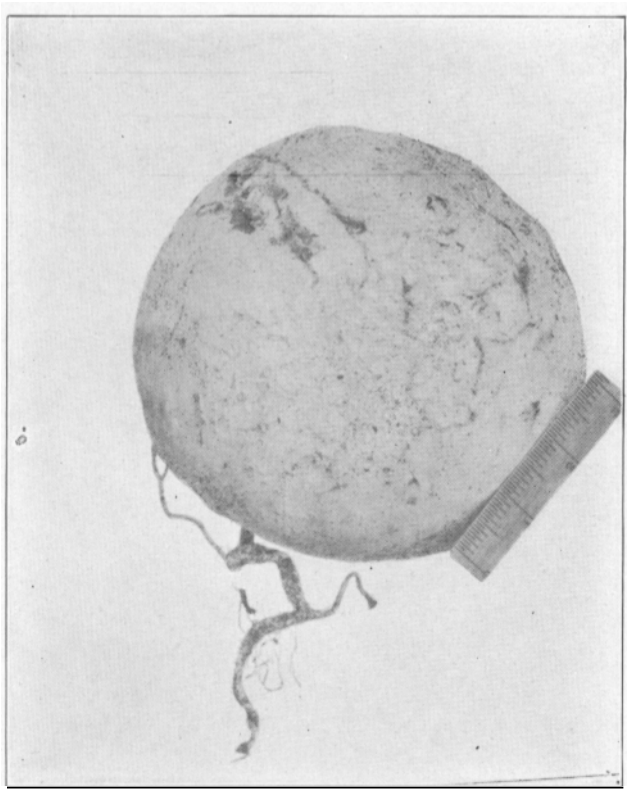
DICTYOPHORA DUPLICATA.

PLATE III.



ITHYPHALLUS IMPUDICUS

PLATE IV.



ITHYPHALLUS IMPUDICUS (UNEXPANDED).

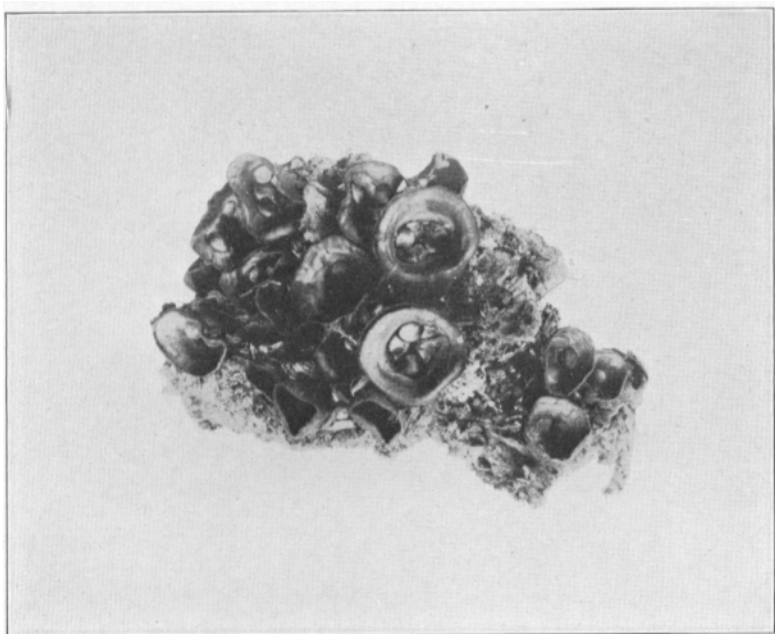


Fig. 1 *CYATHUS VERNICOSUS*.

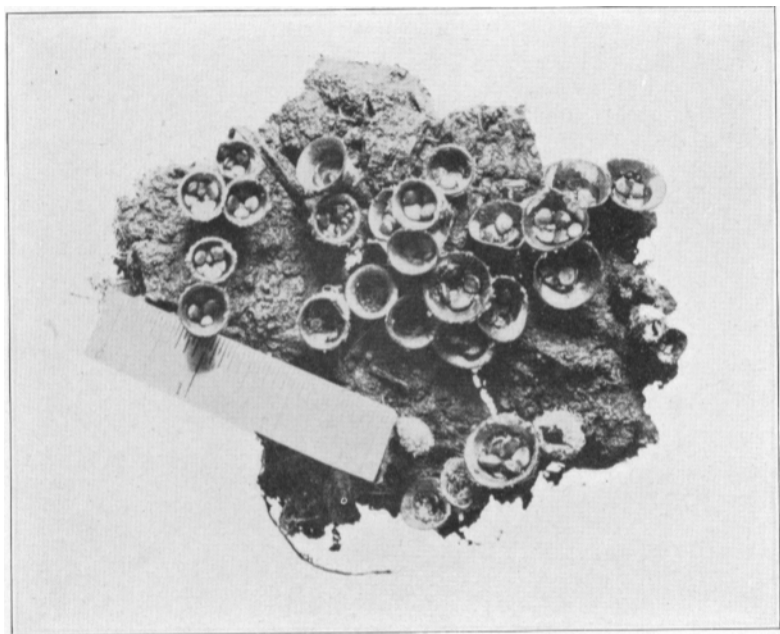


Fig. 2 *CYATHUS STERCOREUS*.



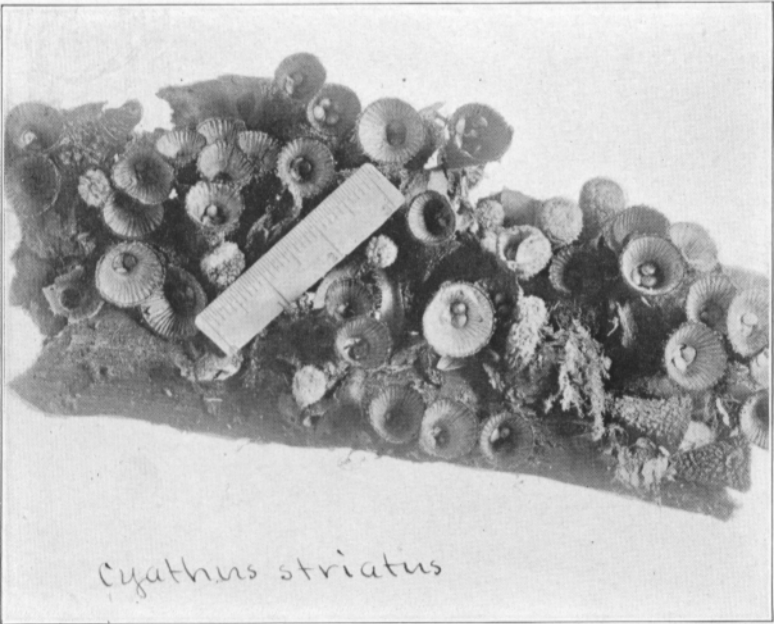


Fig. 1. CYATHUS STRIATUS.

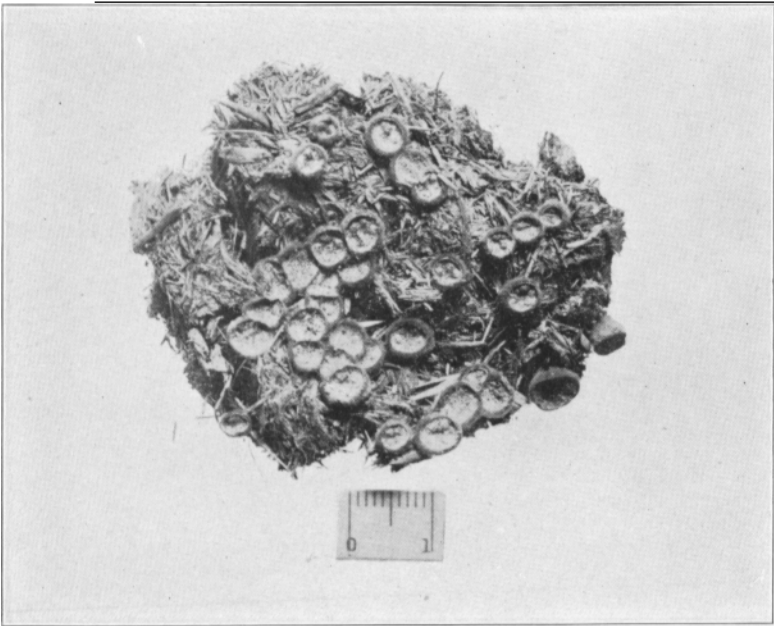


Fig. 2. CRUCIBULUM VULGARE.

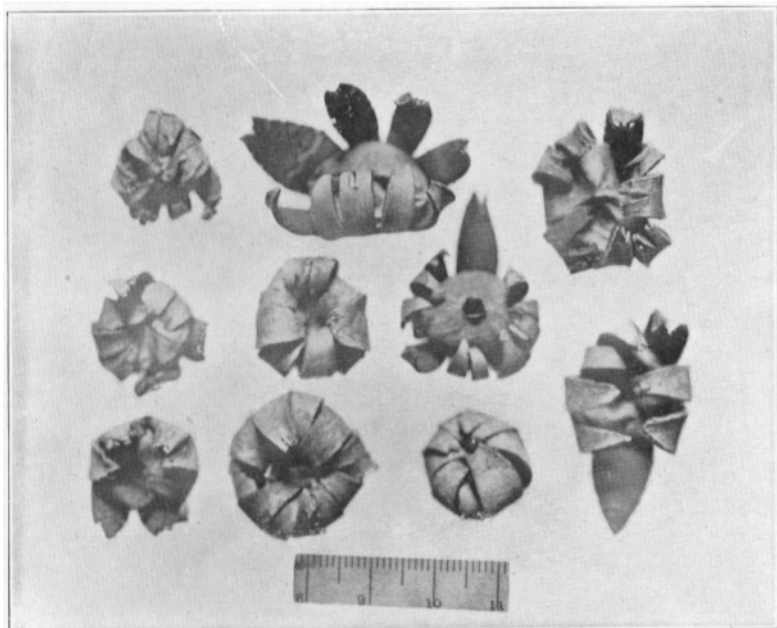


Fig. 1. *GEASTER HYGROMETRICUS* (closed).

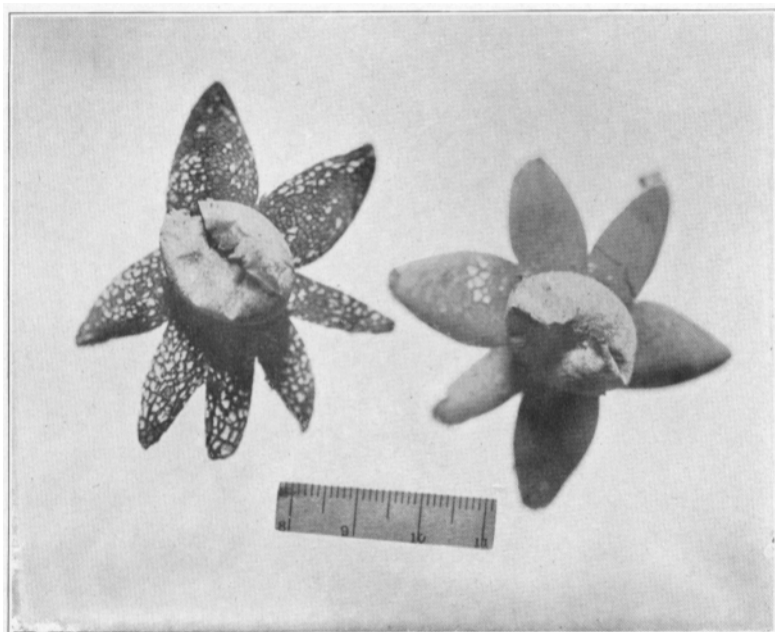


Fig. :2. *GEASTER HYGROMETRICUS* (open).



Fig. 1. GEASTER DELICATUS.

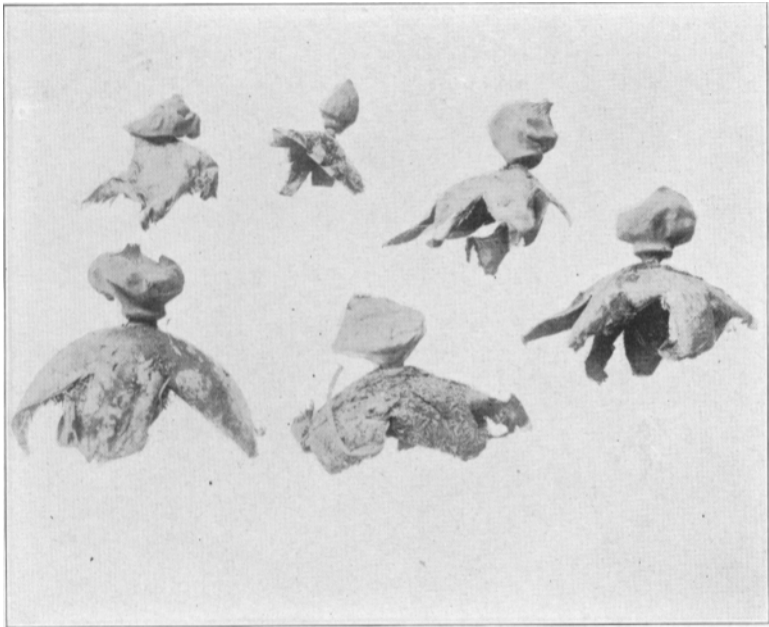
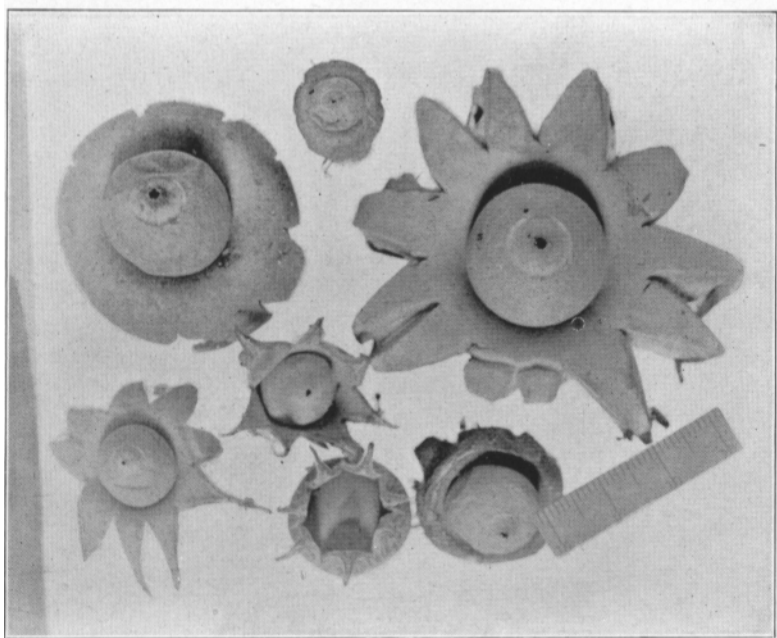


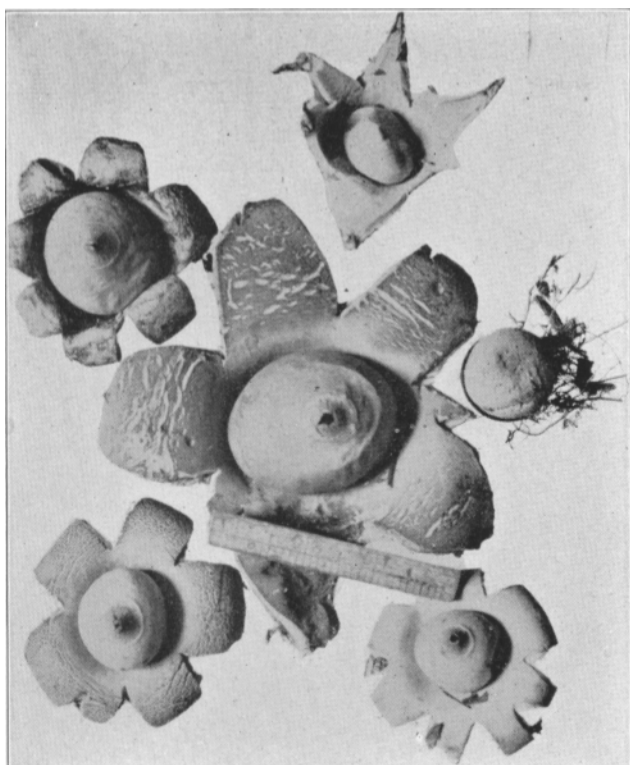
Fig. 2. GEASTER SCHMIDELII

PLATE IX.



GEASTER SACCATUS.

PLATE X.



GEASTER SACCATUS.

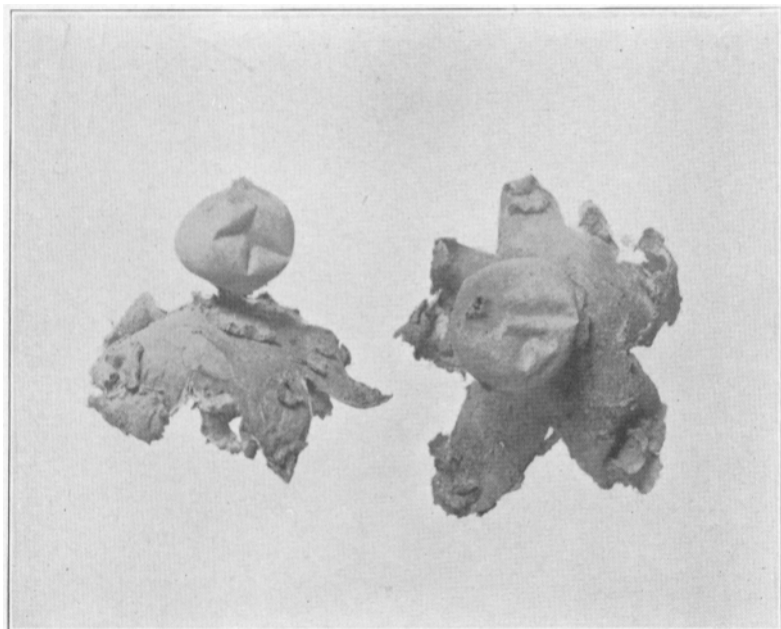


Fig. 1. *GEASTER TRIPLEX*.



Fig. 2. *GEASTER RUFESCENS*

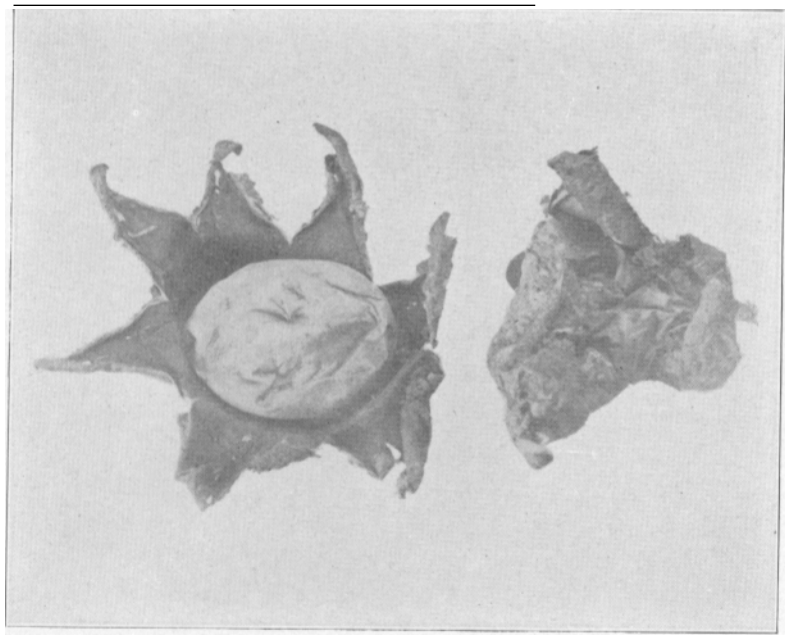


Fig. 1. GEASTER LIMBATUS.

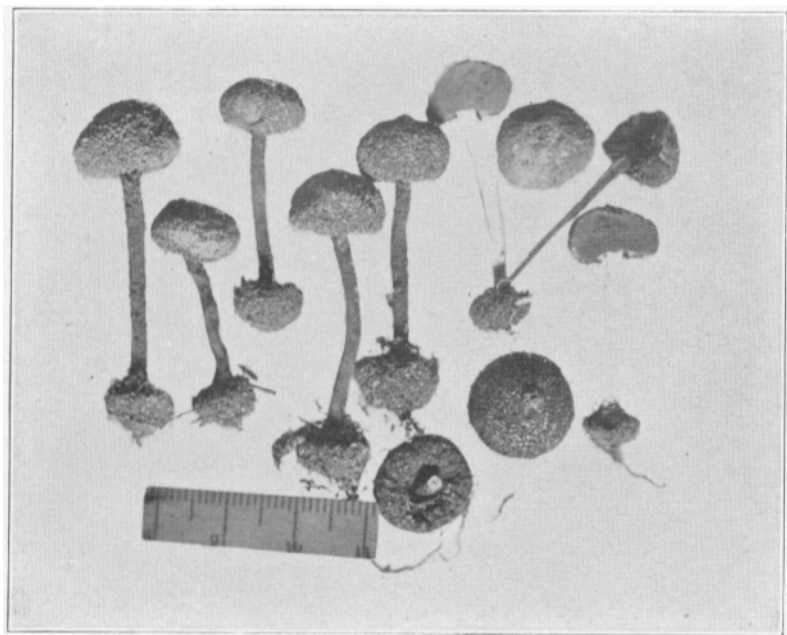


Fig. 2. TYLOSTOMA CAMPESTRE.

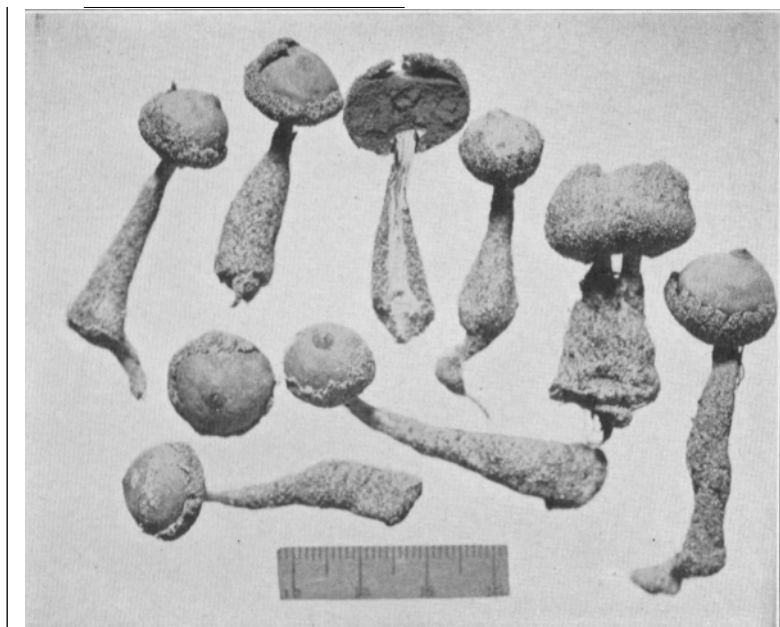


Fig. 1. TYLOSTOMA POCULATUM.

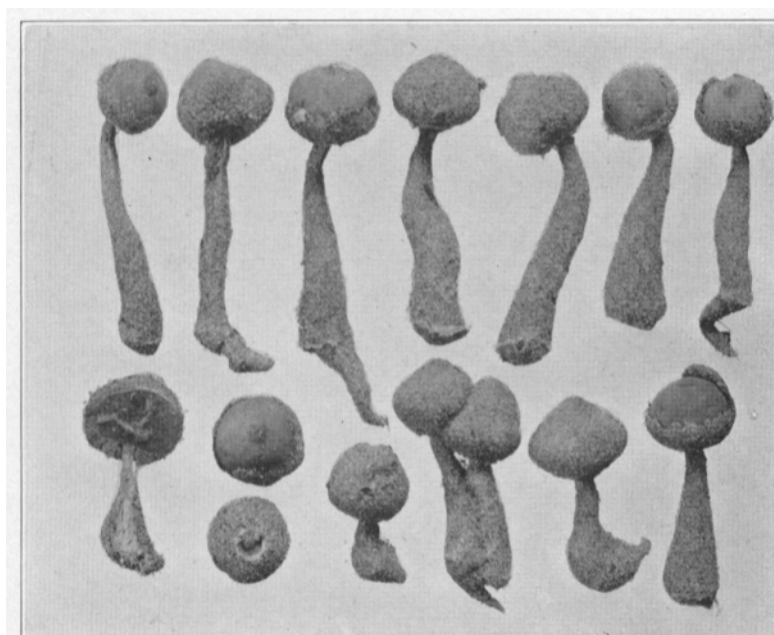
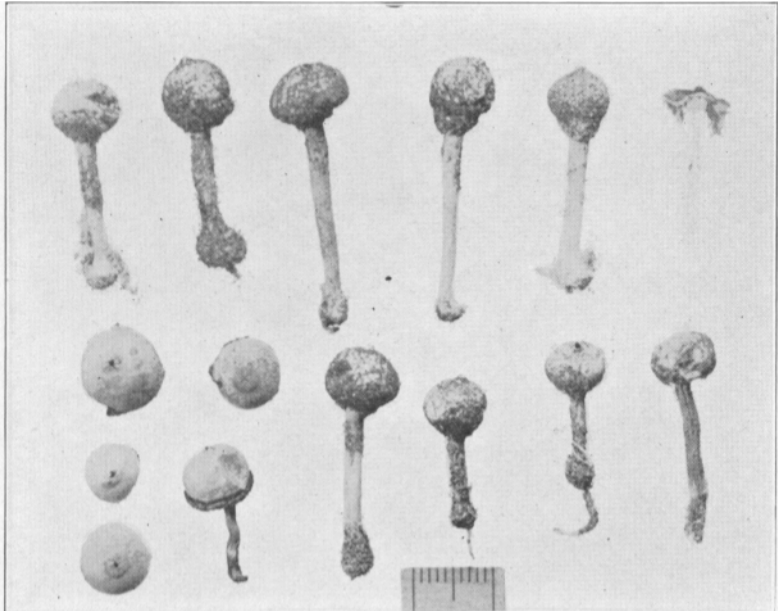


Fig. 2. TYLOSTOMA VERRUCOSUM.

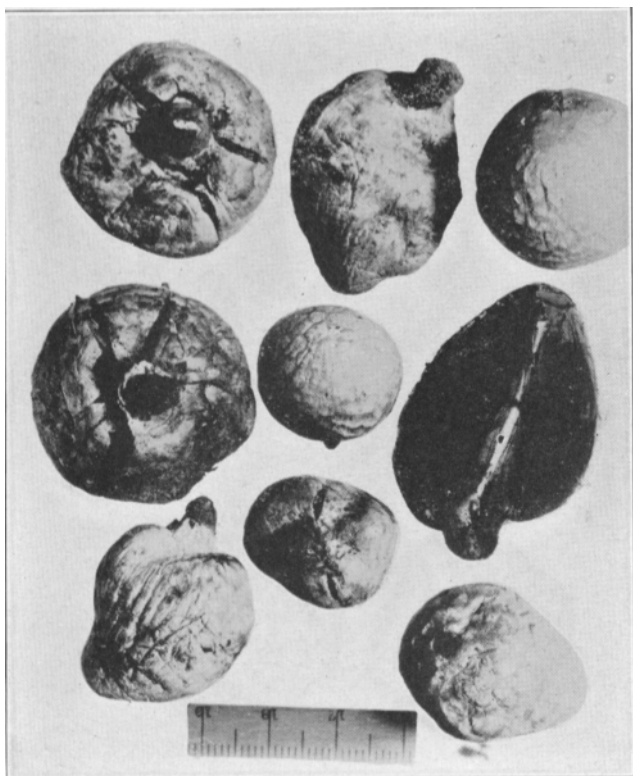


PLATE XIV.

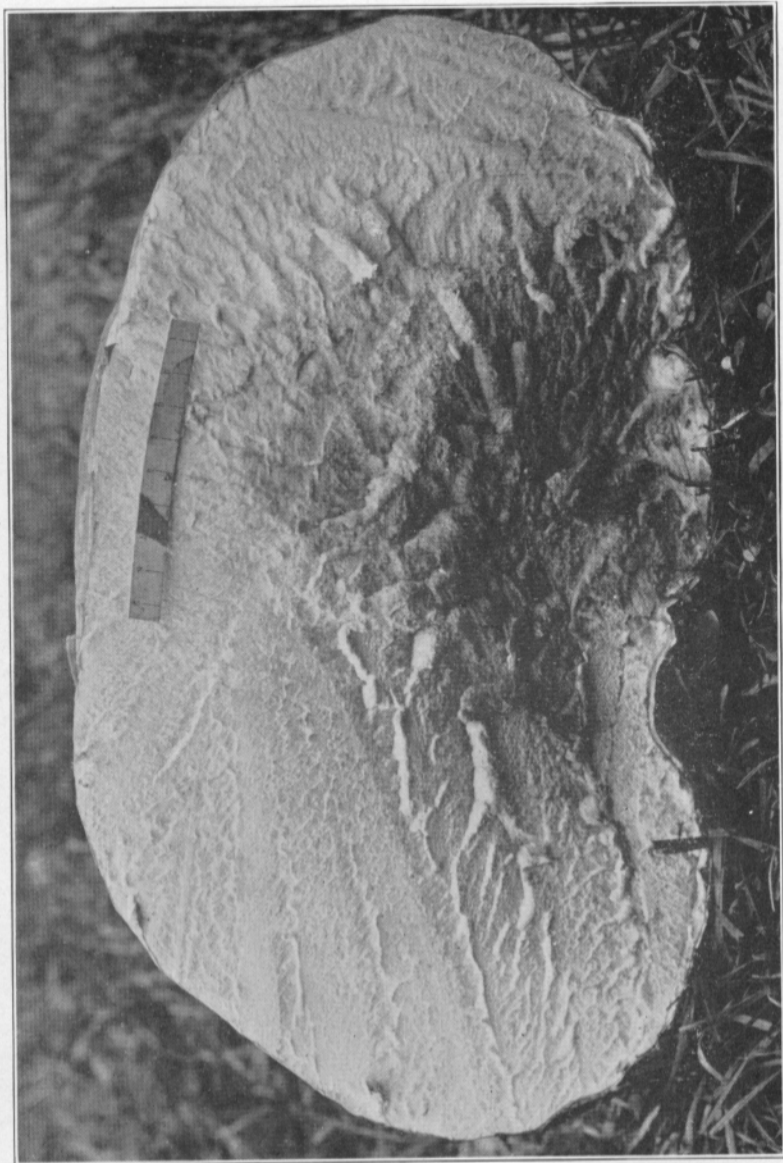


TYLOSTOMA MAMMOSUM, VAR.

PLATE. XV.



SECOTIUM ACUMINATUM.



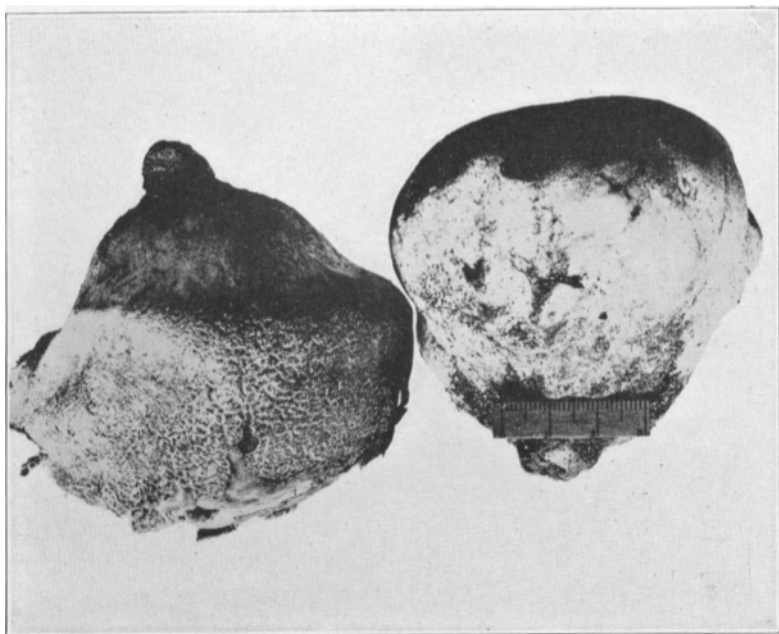
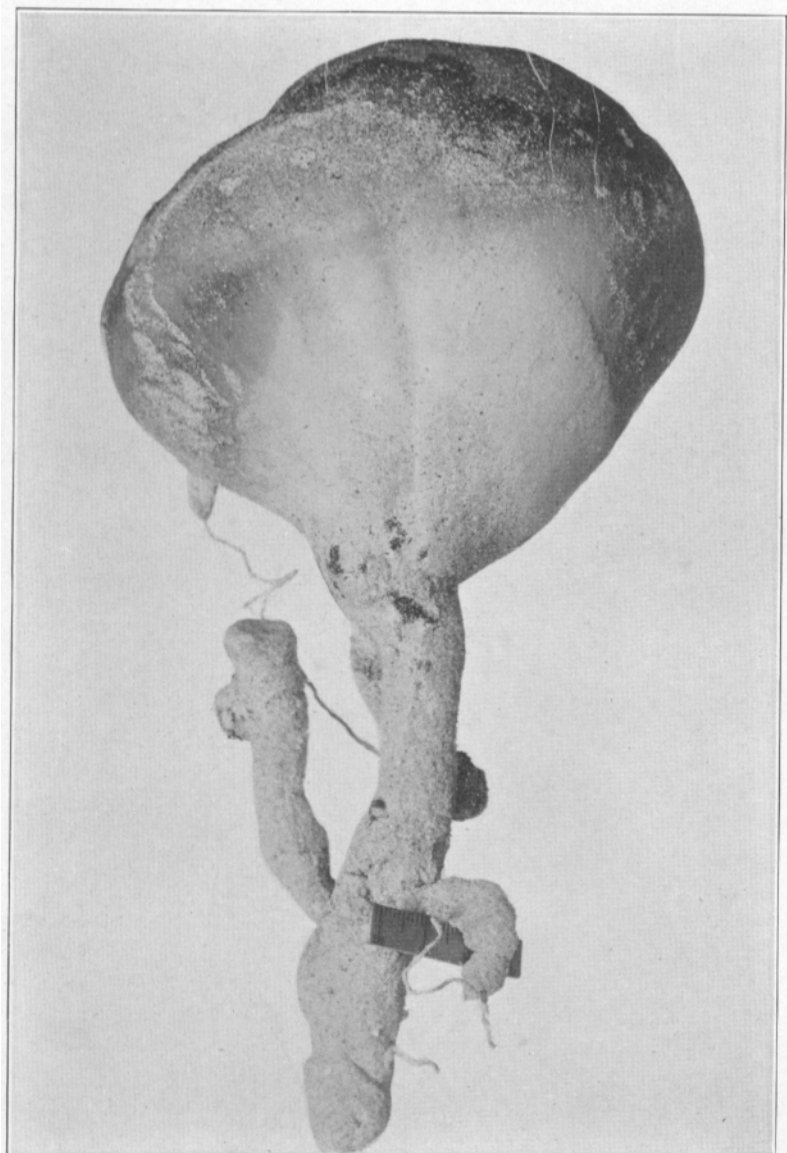


Fig. 1. CALVATIA CYATHIFORME.



Fig. 2. CALVATIA CRANIIFORMIS.



CALVATIA RUBRO-FLAVA.

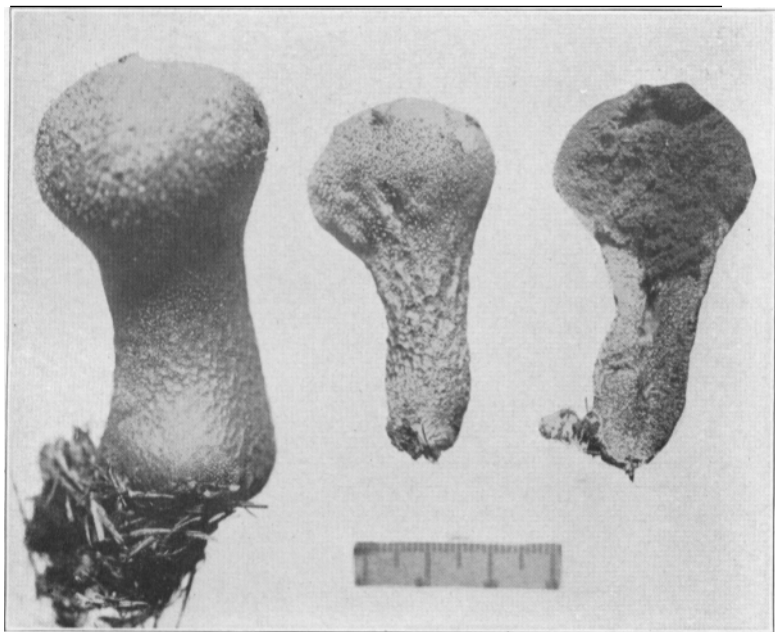


Fig. 1. *CALVATIA SACCATA*.

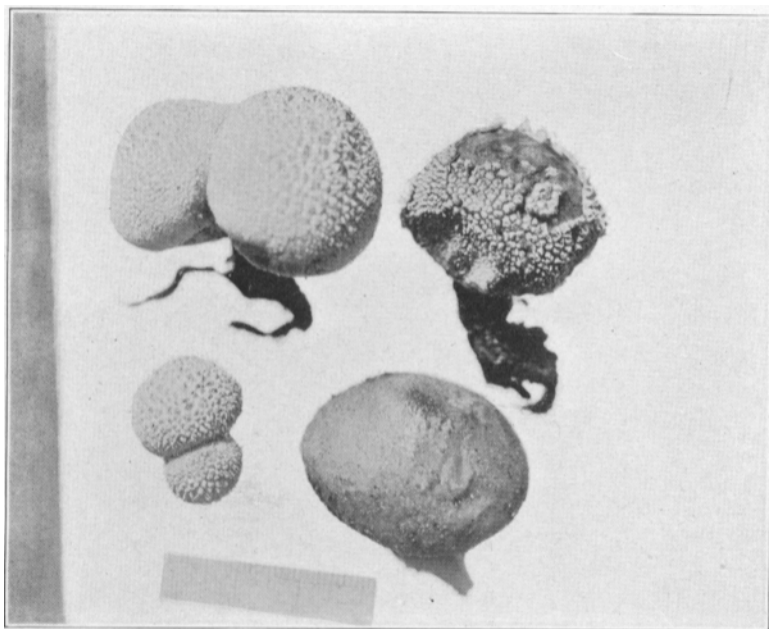


Fig. 2. *LYCOPERDON PULCHERRIMUM*.

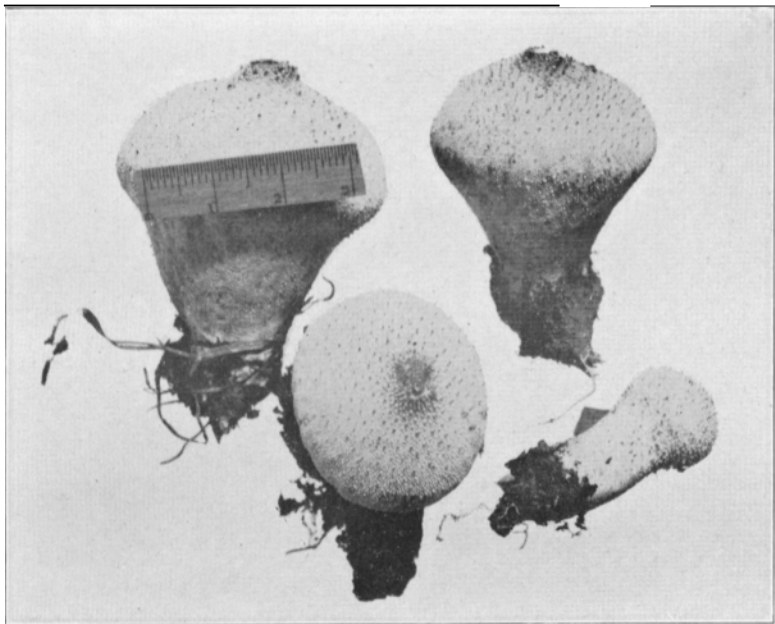


Fig. 1. LYCOPERDON GEMMATUM.

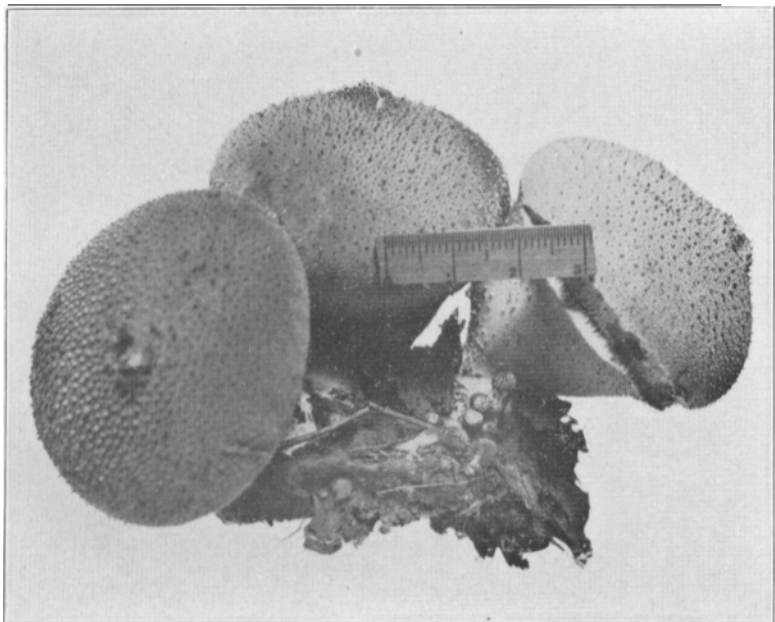
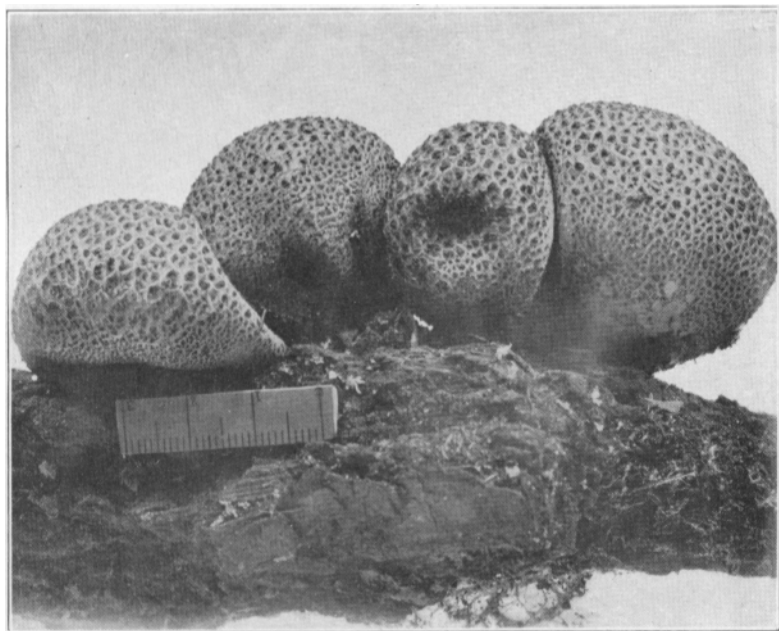


Fig. 2. LYCOPERDON GEMMATUM

PLATE XXI.



LYCOPERDON PYRIFORME.



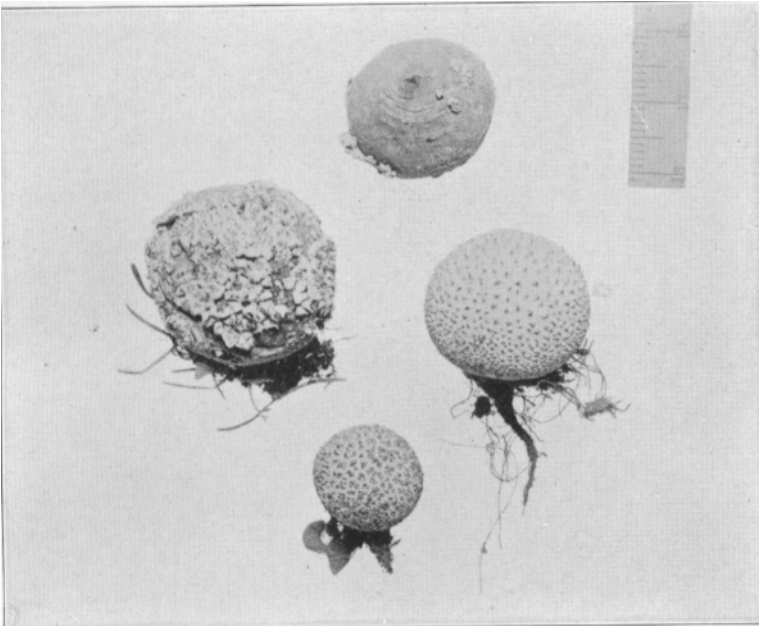


Fig. 1. LYCOPERDON CRUCIATIUM.

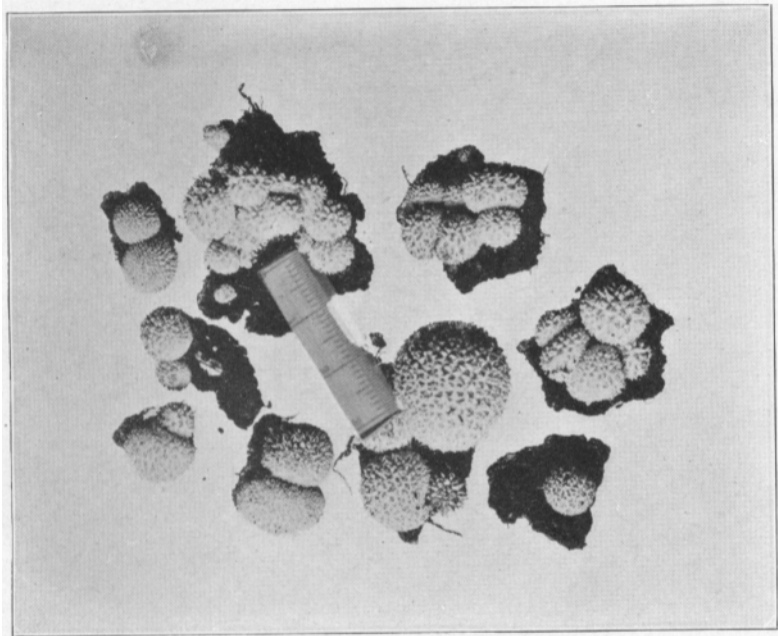


Fig. 2. LYCOPERDON WRIGHTII.

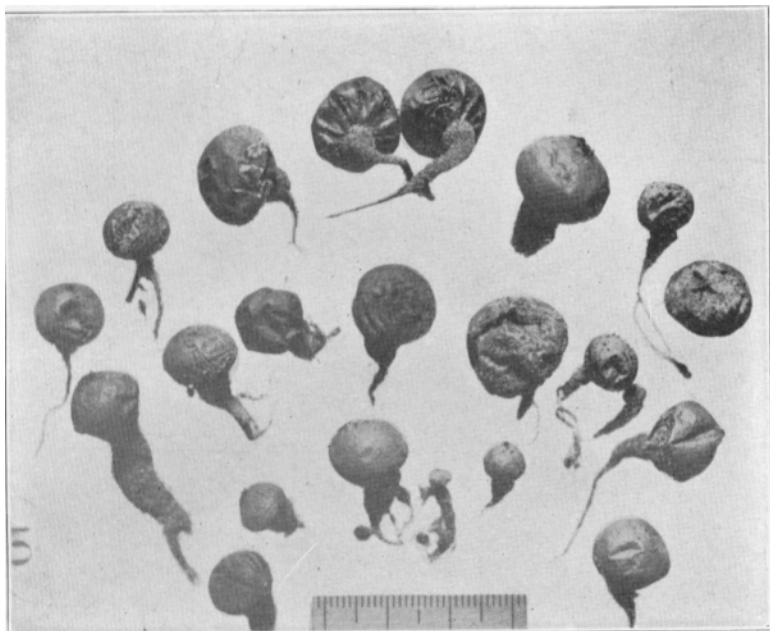


Fig. 1. LYCOPERDON PUSILLUM.

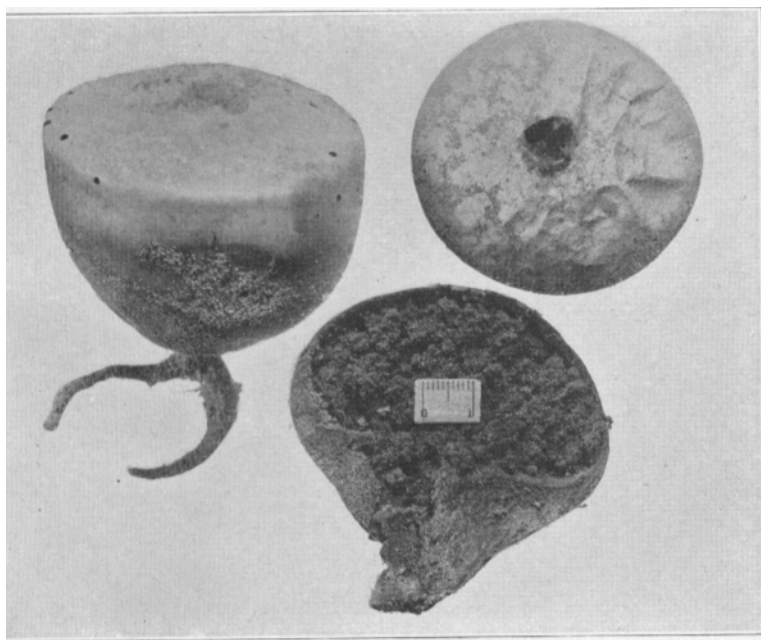


Fig. 2. BOVISTELLA OHIENSIS.

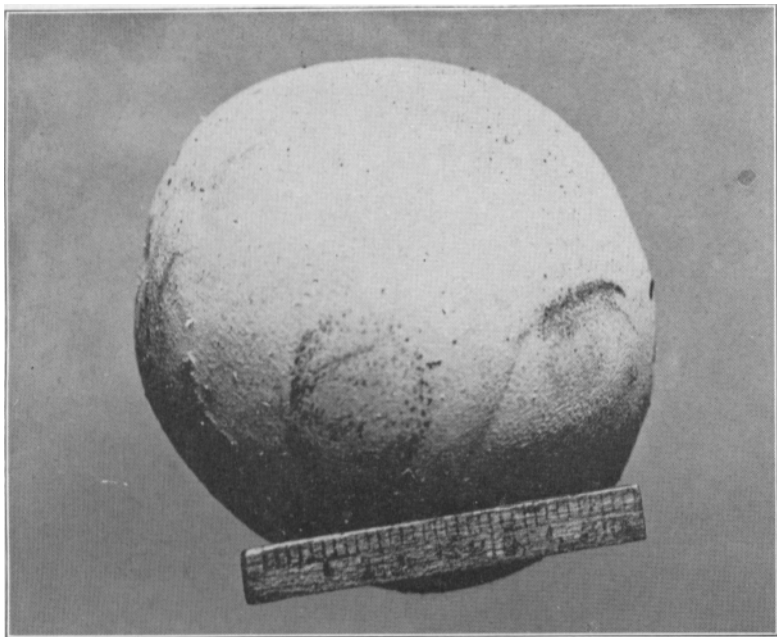


Fig. 1. BOVISTA PILA.

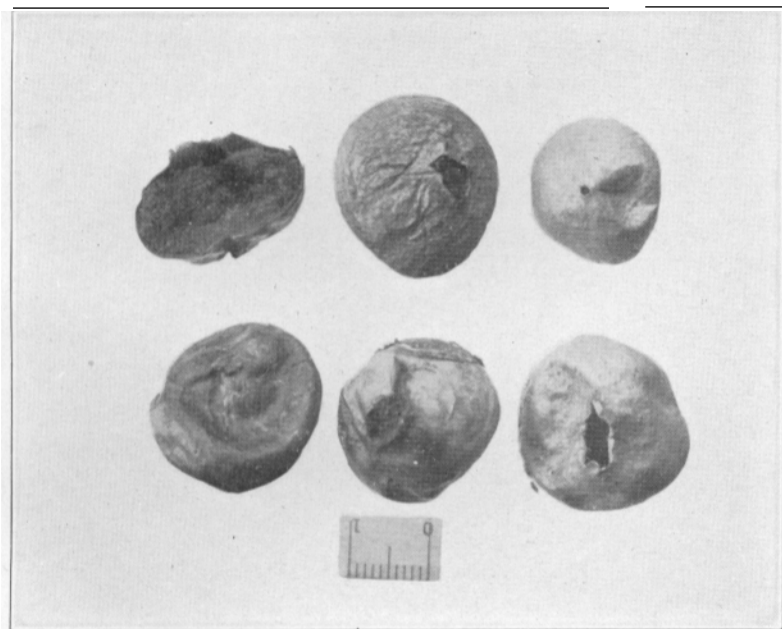


Fig. 2. BOVISTA PLUMBEA.



Fig. 1. MYCENASTRUM CORIUM.

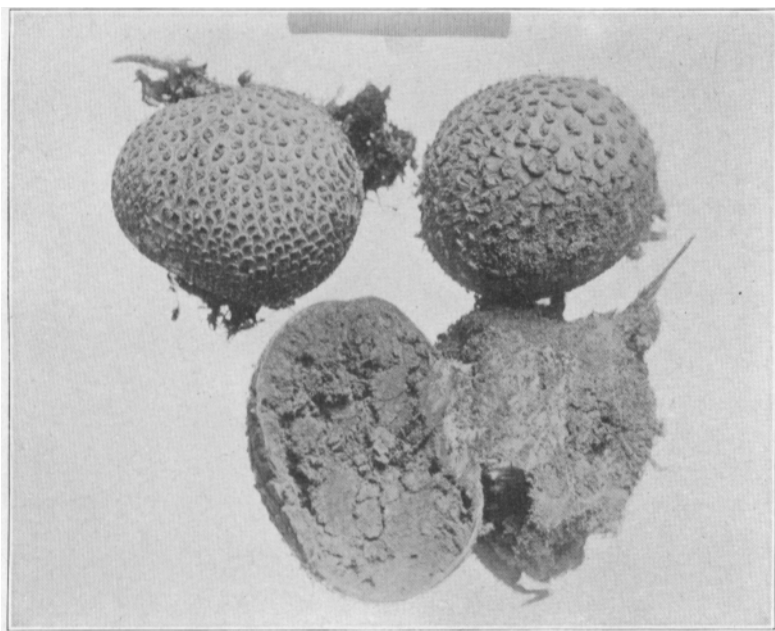


Fig. 2. SCLERODERMA VULGARE.

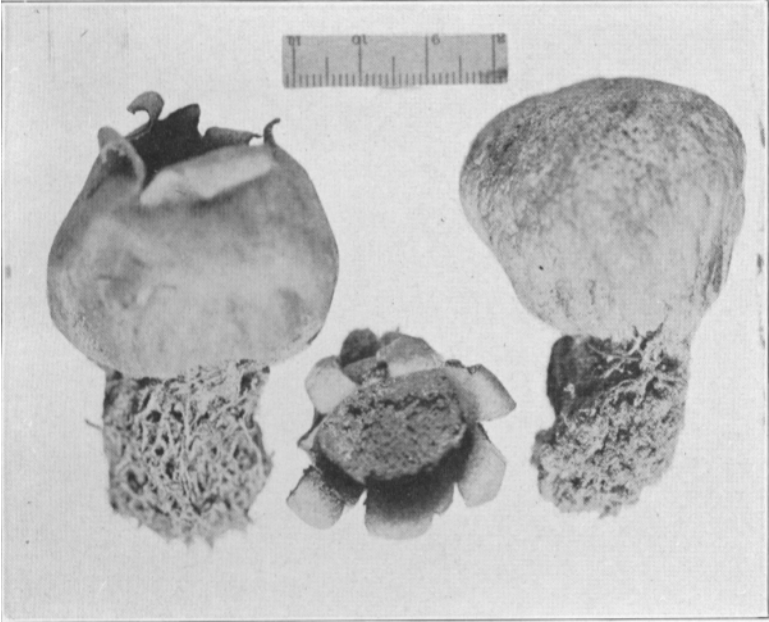


Fig. 1. *SCLERODERMA FLAVIDUM*.

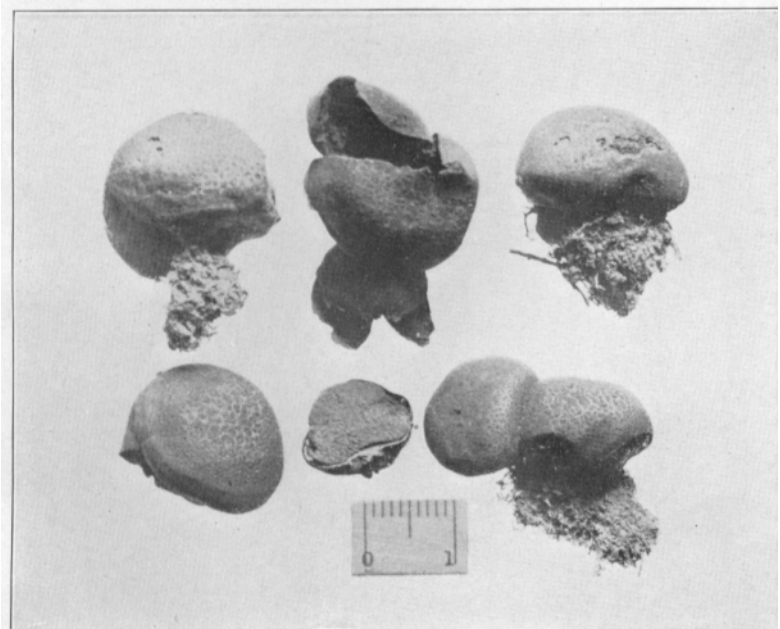


Fig. 2. *SCLERODERMA TENERUM*.